

ON THE PTEROCERÆ OF LAMARCK, AND THEIR MUTUAL RELATIONS.

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From the earliest times of scientific zoology, there has been almost universally recognized as a natural group,* and with its proper affinities as since demonstrated, that group of living Strombidæ provided with a digitated expanded lip, with which the Lamarckian name of *Pterocera* has been most generally associated. Whether the mutual relations of the components of that group have been equally well appreciated will be the subject for present inquiry.

§ 1. DIFFERENTIAL CHARACTERS.

1. *Primary spines and their homologies.*

Accepting the current views, ten recent species of *Pterocera*, as defined by Lamarck, are distinguishable, and these differ in the number of alar digitations, the direction of the digitations, their distribution, and their relative size, the form of the aperture, as well as the presence or absence of rugosities on the lip, and other trivial characters.

As to the number of digitations, the difference would at first appear to be very great, but more extended study demonstrates that it is more apparent than real, and that, in the case of species with an enlarged number of digitations, a distinction should be made between primary and secondary or intercalary ones.

Eliminating for the present such secondary or intercalary digitations, the species of the group are distributable into two minor groups; one distinguished by the major development of six primary digitations, (exclusive of the canal), and the other by

* To it, however, have been referred species which are not closely related to the species of the natural group, and which have only an analogical resemblance to such.

the presence of only five ; tracing those digitations to their origin, it is further found that a still more important distinction prevails, and that they are very differently grouped and developed from entirely different elements.

In the one group, that embracing the largest number of species,—those having six digitations, and of which *P. lambis* is a representative,—the distribution is as follows :

1st. Just below the suture is a fasciole, (*sutural*), but little differentiated, which finally trends upwards on the spire, and terminates in a single digitation accumbent on the spire, and continued more or less upwards from its apex. 2d. Between the suture and angle, in the mature shell, a fasciole becomes developed which emits a spine (*post angular*) directed backwards. 3d. Around the angle of the cone is a fasciole (*angular*) generally indistinct, but becoming well developed a short distance from the lip in the adult, and terminating in a digitation. 4th. Below or in advance, another fasciole (*pre-angular*) girds the whorl, and also terminates in a digitation ; the distinction between the third and fourth is generally slight, and the angular tubercles covering both in common, they may perhaps be considered as forming a compound fasciole. 5th. Another fasciole (*medial*) girds the whorl around the middle and likewise terminates in a digitation. 6th. Still another (*post-sinual*) emits a spine behind the sinus ; an ante-sinual fasciole is unarmed ; as is also a lobal. The canal terminates in a long tortuous digitation curved towards the right. Finally, reference must not be omitted to an auriform lobe with which the posterior digitation is sometimes furnished towards the left.

In the second group, represented by *P. chiragra*, a very different distribution prevails. 1st. The *sutural* fasciole is represented by two diverging branches, one of which (*sutural*) continuing its quasi-sutural course, terminates in a spine which at base crosses the spire, and is curved towards the left and upwards, and the other (*sub-sutural*) terminates in a spine pointed backwards ; 2d, the *angular* fasciole is undivided, and terminates in a single spine, curved outwards and backwards ; 3d, the *medial* fasciole is also simple, and terminates in a single recurved spine ; 4th, the *postsinual* fasciole is simple, and *edigitate* ; 5th, the ante-sinual fasciole is well developed, and the lobal terminates in a large recurved spine ; the siphonal canal is cornuform and recurved towards the left.

As to the homologies between the digitations of the species of this group and those of the preceding, there can be no doubt, after due study.

The large posterior digitation recurved to the left represents

the sutural one of *P. lambis*, *P. pseudoscorpio*, *P. elongata*, *P. violacea*, etc.

The angular digitation is homologous with the (median) angular of *P. lambis*, &c.

The lobal digitation has no developed homologue in front of the inflected lobe of *P. lambis* or its associates, although the fasciole may be distinctly developed.

Of course, no doubt can exist as to the homologies of the siphoniferous canal, however much the lobal digitation of the one and the anterior one of the other may correspond in apparent position or curvature, and the difference in direction of the siphonal canal, and its simple trend towards the left in *P. chiragra* is therefore to be regarded in some manner as the reflection of the development of the post-lobal digitation and formative element in that type.

The relations and differences between the armature of the two groups thus distinguished, may be expressed in a concise manner by the following formula :

<i>P. lambis</i> , &c.	Spines.	<i>P. chiragra</i> , &c.
1	Sutural.	1
0	Subsutural.	1
1	Postangular.	0
1	Angular.	1
1	Preangular.	0
1	Medial.	1
1	Postsinual.	0
0	Lobal.	1
Inclined towards right, 1	Siphonal.	1, curved toward left.

2. Secondary spines.

While in most of the Lamarckian *Pteroceras*, the primary spines enumerated are the only ones developed, in one of the groups there are species which possess, in addition, smaller spines interposed between, and more rarely, such intercalary

* Pathology, which has furnished such aid to Physiology and Anatomy, may be invoked with advantage in Conchology. A malformed specimen of *P. lambis* exhibits a peculiar arrangement of the sutural digitations and perhaps furnishes a hint as to the possible manner of divergence of the two types so distinct at the present day. The last whorl, at its commencement, is rapidly deflected and thence regularly continued much below the suture, but trends upward as usual towards the matured lip; instead of a single digitation concurrent with the spire, there is a primary malformed one, which trends backwards like the subsutural of *P. chiragra*, and another diverging from and crossing the spire towards the left, as the sutural in *P. chiragra*. An excessive deposit of callus has obliterated the canals at the base.

spines are nearly as large as the primary ones. In order to appreciate the value of this character, it will be advisable to pass all the species in review.

1st. *P. lambis* and its nearly related congeners, *P. erocata*, and *P. bryonia*, have a perfectly entire lip between the primary digitations.* (Digitations S. 1, A. 1+1+1. M. 1. P. 1.)=6.

2d. *P. scorpio* and *P. pseudoscorpio* are provided with small dentiform processes, caused by the expansion of the larger revolving striæ at their ends.

In *P. pseudoscorpio* there are two, one between the pre-angular and medial spines, and another between the medial and post-sinual. Digitations (S. 1. A. 1+1+1. (r). M 1. (r). P. 1.)=6+2 r.

In *P. scorpius*, however, not only do the corresponding striæ and those on each side thus terminate, but those diverging and running out on the sides of the digitations expand and are abruptly truncated, thus producing the nodose appearance of the digitations of that species so characteristic of it. Digitations (S. 1. (r) A. 1 (r) 1 (r) 1. (rx). M. 1. (rx). P. 1.)=6+rx.†

3d. *P. millipeda*, *P. elongata*, and *P. violacea* exhibit, at the margin of the lip, in place of dentiform processes like those of *P. scorpius*, more or less developed and channelled digitations, and the fascioles corresponding to them are generally developed, and almost as well defined as the primary ones. In *P. millipeda*, however, they are sometimes no more defined than in *P. lambis*.

In *P. elongata* three angular spines are alone developed, (at least generally,) as in *P. lambis* and *P. scorpio* and their allies. Digitations (S. 1. A. 1+1+1. (I.) M. 1. (I.) P. 1.)=8.

In *P. millipeda* an intercalary digitation is interposed between the sutural and post-angular.‡ Digitations (S. 1. (I.) A. 1+1+1. (I.) M. 1. (I.) P. 1.)=9.

* Reference is had only to the margin behind the sinus in all cases.

† In this connection it may be remarked that a specimen of *P. scorpius*, in the collection of the Smithsonian Institution, exhibits intercalary spines like *P. millipeda*; one between the lower angular and median, and another between the latter and postsinual; the lip had been broken after having commenced to send forth its spines; the primary spines are thrown farther out from the lip, and the median one is smaller than the secondaries. The characteristic œdematous condition of the spines has not been developed, and the specimen was referred by Dr. P. P. Carpenter to "*P. pseudoscorpio*," but the left basal lobe of the posterior spine, the elevated white ridge below the hollow of the dorsal tubercle, and the armed lip (features characteristic of *S. scorpius*, but hitherto unnoticed) unequivocally point out the true relations.

‡ The supernumerary digitation is sometimes undeveloped, as in *P. elongata*; there is, it may be added, no connection between such atrophy and that of the intercalary fascioles.

In *P. violacea* there are three angular (including post- and pre-angular) digitations as in *P. millipeda*, and instead of one median fasciole there are two. Digitations (S. 1. A. 1+1+1. (I.) P. M. 1. (I.) (A. M. 1 (I). P. 1.)=10.

3. Aperture.

Two quite different forms of aperture are recognizable in the Lamareckian genus. In *P. lambis*, &c., the aperture is linear, about equally wide from front to rear, and almost coequal in length with the whorl, and the cavity of a large tubercle which generally exists in the angular fasciole is open to view; a transverse fold is, however, on the columella behind and combines with a similar one generally developed on the opposite lip, behind or in front of the cavity, to form a constriction between the aperture proper and a canal emptying into the posterior or marginal digitation. All the species resembling *P. lambis* in the number and distribution of the primary spines agree likewise in the form of aperture.

P. chiragra and *P. rugosa* have an unguiform or claw-shaped aperture, but little curved, and the region of the angular tubercle and cavity is concealed by the contraction of the aperture, produced by longitudinal plication of the columella and a corresponding development of the labral surface.

4. Character of lip surface.

The species of the group exhibit much difference in the character of the surface of the lips, some having a very smooth and polished callous surface, while in others the surface is much wrinkled and folded. They may be considered in order of development.

1st. In *P. lambis* *P. bryonia* and *P. crocata*, the lips are covered with a perfectly smooth callous coat.

2d. In *P. chiragra* the margins of the aperture are delicately wrinkled, the wrinkles being white.

3d. In *P. violacea* the surface of the outer lip is delicately wrinkled, while the rugæ of the inner are still fainter.

4th. In *P. millipeda* the wrinkles are about equally developed on the surface of both lips, but they are comparatively little raised.

5th. In *P. scorio*, *P. pseudoscorpio* and *P. elongata* as well as *P. rugosa*, the wrinkles are very prominent, and pearly white, strongly contrasting with the purple intervals.

§ 2. TAXONOMIC DEDUCTIONS.

Having thus examined the modifications of the principal differential characters which distinguish the species of *Pterocera*,

it remains to apply the information gained to the combination of the several forms.

1st. In the number, position and direction of the primary spines, and in the form of the aperture, there is a close and essential similarity between *P. lambis*, *P. bryonia*, *P. crocata*, *P. scorpius*, *P. pseudoscorpio*, *P. millipeda*, *P. violacea* and *P. elongata*.

2d. On the other hand, in all such respects, *P. chiragra* and *P. rugosa* differ very much from the others and equally closely agree with each other.

As to the intercalary spines, the extreme species of the first of such groups differ widely, but are connected by a series of species exhibiting intermediate character.

As to lip surface, there is likewise a considerable difference between the extreme species of the same group, but between such are interposed the species *P. violacea* and *P. millipeda*.

In the second group the two species exhibit almost equally great difference in the character of the lip surface, although in other respects so closely allied.

It will be apparent that there is no coincidence between the development of the wrinkled lip surface and of the intercalary spines, unless indeed it be admitted that the dentiform labral lobes of *P. scorpius* and *P. pseudoscorpio* are spines. Such an admission would, however, be a virtual confession of the insignificant value of the development of the intercalary spines. On the other hand, the comparison of *P. violacea* with *P. millipeda*, and of *P. chiragra* with *P. rugosa*, attest to the slight value of the presence or absence of the rugosities as distinctive of natural groups.

Full consideration would therefore appear to necessitate the combination of *P. lambis* and those already enumerated as associates in one natural group, and of *P. chiragra* and *P. rugosa*, in another, and in accordance with the prevalent valuation of groups, such would seem to be well entitled to generic rank. What names such genera should bear must be a subject for special investigation, and a review of the literary history is requisite.

§ 3. HISTORY.

The founder of the binomial nomenclature associated all the species known to him, as well as representatives of the genus *Aporrhais* and of *Rostellaria* in the genus *Strombus*, in a section (the first or "Digitati"), characterized by the digitated lip. The genus was first subdivided by a binomial systematist, in 1797,—Humphrey, in the "*Museum calounianum*," published in that year, combining together the species of the section Digitati of Linné, and reserving for it the name *Strombus*, while for those with a simple lip he proposed the name *Alatus*, but neither

name was accompanied with a diagnosis or remarks of any kind, and their extent are only determinable by their contents and the synonymy given of the included species.

Lamarck subsequently (in 1799) subdivided the same Linnæan genus, reserving the name *Strombus* for the species with a simple alated lip, and bestowing that of *Pterocera* on those characterized by a digitated labrum, (excepting, however, the *S. pespelecani* and *S. fusus*) each genus being circumscribed and defined by an appropriate diagnosis and reference to specific types. The *Strombus lambis* of Linné was named as the type of *Pterocera*. The genera thus limited were, as is well known, very generally accepted by succeeding naturalists, and without modification for a long period.

In 1851, however, Dr. O. Mörch, in the catalogue of the Yoldi collection, while retaining the name *Pterocera* in the Lamarckian sense, subdivided the group, but without accompanying diagnoses, or limitation by any remarks, into three subgenera, for which he adopted the Kleinian names *Harpago*, *Millipes* and *Heptadactylus*; he included in the first the "*chiragra*," and "*arthritica*," as well as "*pseudoscorpio*;" in the second "*millipeda*" and "*scorpius*;" and in the last "*lambis*" and its near associates. The association of "*pseudoscorpio*" with "*chiragra*" and "*rugosa*," was perhaps inadvertent, the result of a printer's error or a lapsus calami. The brothers Adams, with the amendments so required, accepted the three subgenera, and at the same time supplanted the name *Pterocera* by *Harpago*, as that of the including genus. The "genus" was defined so as to include all the species; the "sub-genus *Millipes*, Klein," was characterized by the "outer and inner lips corrugated, digitations of outer lip numerous," and the "sub-genus *Heptadactylus*, Klein," by the "outer and inner lips smooth; digitations not numerous;" the typical sub-genus was not defined, and would therefore receive the residuum,* covered by the generic diagnosis, and eliminated by the diagnoses of the other subgenera—a course conducive to economy of time and thought, but of doubtful expediency.

A still different association of species has lately been proposed by Mr. Gabb (American Journal of Conchology, iv, 139), who has also adopted the Lamarckian genus in its integrity, and with the same limitation by diagnosis as Lamarck had provided, but he has subdivided it into two subgenera, *Pterocera* and the "sub-genus *Millipes*, H. & A. Adams," distinguishing the latter by the "margins of aperture transversely wrinkled and corru-

* Such a residuum would include a large number of extinct forms, some of which have been actually referred to the genus by Chenu.

gated," and leaving the residuum eliminated by such diagnosis in the remaining and otherwise not restricted sub-genus.

It is also necessary to recall that Klein had, as early as 1753, proposed for species of this group the pseudogeneric names *Radix-bryoniæ*, *Harpago*, *Heptadactylus* and *Millipes*.

"*Radix bryoniæ*" formed "genus xii" of his "classis ii, (*Voluta longa*)," and the others, respectively, genera ii, iii and iv of his "classis iv, (*Alata*)" of his "sectio ii, *Cochlis composita*,"—the latter being one of two groups into which Klein divided the univalve shells, and whose only common character was (applicable to a limited extent only), based on the obconic or cylindroid form of the large body whorl, and the comparatively small spire,* which conveyed to Klein the idea of two spiral shells having a common base. His class "*Voluta longa*" was based on the obconic or oblong form capped by a little prominent spire,† and his "*Alata*," accepted from Rumphius, on the alation of the outer lip, and the sinus with which that lip is furnished towards the front.‡ The characters of these groups not being comparable or contrasted, it is not to be wondered at that a man like Klein should have referred the same form to two classes [*i. e.* families] especially if that form possessed the characters of each. And in truth Klein's genera *Radix bryoniæ* and *Heptadactylus* are based on the same form, but then they really have the characters of the classes in which they are respectively placed! *Radix bryoniæ* has the obconic form (and so does *Heptadactylus*) of the *Voluta longa*, and *Heptadactylus* has the alate and sinuated lip of the *Alata* (but which likewise *Radix bryoniæ* possesses)! Klein's failure to perceive the relations in this case may be supposed to have resulted from the immature condition of *Radix bryoniæ*, the digitations being little developed;§ *Harpago* was distinguished by its six spines, of which one, the largest, followed the direction of the spire, and two, one on each side of the first,

* Klein's diagnosis was as follows: "*Cochlides compositas* dicimus, in quibus duplex testæ circumvolutio, ita ut quasi ex duabus cochlidibus videatur composita." P. 59.

† "*Cochlides volutæ* dicuntur *longæ*, quæ, præter ventris oblongi gyros internos, alios ex basi producent externos." P. 64.

‡ "*Alatas* dicimus, cum *Rumphio*, cochlides compositas, quæ labium insigniter expandunt, & ad anteriorem canaliculum sinum excissum habent. Si labium in murices abit, dicuntur speciali nomine: *Cornuta*." p. 97.

The class *Alata* corresponds to the *Alata* or *Strombidæ* of modern naturalists, after the exclusion of the *Rostellarie*, and Klein's acceptance of so natural an assemblage does not permit one, as so often tempted, to utterly deny him any judgment or power of appreciation and valuation of characters.

§ "Genus xii. *Radix bryoniæ*. § 211. Huic radici assimilamus *volutam* conicam in decurrente mucrone radiatam." p. 79.

were curved towards each other like the horns of a cow.* *Hepta-dactylus* was distinguished by the development of seven spines,† and *Millipes* of ten or eleven.‡ The genus *Harpago* would be equivalent, so far as the diagnosis and known species are concerned, to the natural group of which *P. chiragra* and *P. rugosa* are the representatives. *Hepta-dactylus* includes the species *P. lambis* (Kleinian species 1, 2, 3, 4 and 5,) and *P. scorpio* or *P. pseudoscorpio* (K. s. 6,) as well as one of the *chiragra* group (K. s. 7,) to which, it is almost needless to say, the diagnosis is not applicable; finally, *Millipes* includes two nominal species identifiable with *P. millipeda*.

The Kleinian names *Harpago*, *Heptadactylus*, and *Millipes*, were adopted for groups, as already indicated, by Mörch and the Adams brothers, but with modified limits, so far as the species enumerated were concerned; at the sacrifice, however, in the case of the Adams, of conformity between the characters of the species and the diagnosis.

The facts that Montfort, in 1810, applied the modified name *Pteroceres* to the Lamarckian genus, and that in 1822 Fabricius gave the new name *Digitata*, are only of historic interest.

§ 4. REVIEW.

The rules of the British and American associations for the advancement of science are provisionally, at least, adopted.

Under one of those rules, the pseudogeneric names connected with species of this group by Aldrovandi, Klein and others will be at once eliminated from consideration as ante-Linnæan and not binomial.

Under another rule, Humphrey's limitation of the genus *Strombus* to the present forms cannot be accepted, as neither the genus itself nor those eliminated from it were in any manner characterized.§

* "Genus ii. *Harpago*. § 252. Ab uncis dicitur *Trocho-Conus*, labiosus, torosus, tympanosus, in sex murices acutos & aduncos fissus. Ultimus ad mucronem longissimus; duo sequentes & sibi oppositi sunt recurvi, instar cornu bovini; reliqui tres breviores, valde adunci. Testa ab extra alba; maculis fuscis picta. Pentadactylus, *Plinii*." p. 98.

† "Genus iii. *Hepta-dactylus*, § 254. Est. *Trocho-Conus*, labio in septem murices diviso." p. 99. ‡ "Genus iv. *Millipes*. § 256. Est *Trocho-Conus* labiosus & cornutus; ex labio 10, vel 11. murices curvos protendens; super dorso nodoso lineis rufis & nigris pictus." p. 99.

§ This rule is here adopted, as on another occasion, under protest. It is doubtless the duty of an author to state the reasons for such changes from an accepted method as he may deem advisable, and neglect to characterize such genera or other groups to which he first applies names, at least gratuitously transfers the labor of interpreting his own thoughts on another, and, it may be, is too much like obtaining credit on false pre-

Lamarck's name *Pterocera* having been the first one proposed that was binomial and accompanied by a diagnosis, must therefore be adopted; and as it was especially typified by *P. lambis*, it must be retained for the group represented by that species.

Having repeated the diagnoses of the several subdivisions of *Pterocera* proposed by authors, it will be apparent that none have been hitherto based on more than the number of spines and the absence or presence of labial rugosities. It may further be remarked that previous authors have equally failed in their specific descriptions or otherwise to recognize any other than numerical differences, or those of form in the digitations.

With respect to the subdivisions of the Lamarckian genus, Mörch, first of the moderns who subdivided it, gave no diagnoses, and, if he should be judged by his distribution of the species, it would be difficult to surmise his views; but, as already remarked, his chief error was probably typographical or inadvertent.

The diagnoses of the Adams brothers are not consistent with the contents of the genera, two of the five species of *Millipes* (*pseudo-scorpio* and *scorpio*) not having the "digitations of outer lip numerous," but "not numerous," as in *Heptadactylus*, from which they differ, however, by having the "outer and inner lips corrugated." The typical species of *Harpago* have the outer and inner lips corrugated, and digitations not numerous; consequent-

tences. But would not the *spirit* of the rule cited require that the diagnosis should also, besides being *correct* in its original application, be even strictly applicable to the groups with which the name should afterwards be associated? Little consideration would be sufficient to show what confusion would be the result of such interpretation, however. In the group under review, for example, the Linnæan diagnosis of *Strombus* is inapplicable to any group to which an author would now apply the name; *Pterocera*, as characterized by Lamarck, is quite different from that now characterized, and still more apposite are the Adamsian diagnoses of *Harpago*, *Millipes*, and *Pterocera*. The diagnoses of those groups (in one case by implication) are by no means characteristic of their contents. The diagnoses are simply transmutations in combination of two characters; that of *Millipes* really excludes two of the five species referred to, and those two would be relegated to *Harpago*! In this case the authors were more happy in their appreciation than in their verbal limitation. The question naturally recurs then, is a diagnosis that is actually erroneous, and that misleads better than none at all? But if we reply in the negative, and yet accept the rule, how many rejections of accepted names, and what countless changes would the logical application of such a rule entail! The rule, however, has the merit of conveying the sense of naturalists generally, that one has no right to shirk a duty, even should he fail, and that if his time be insufficient, or his power of expression be not adequate to those of appreciation, silence should be his course, unless he can make arrangement with another *willing* to assume the labor he is unable to perform. He, or a recognised representative should, at least, with a new name, reveal the knowledge of which it may be supposed to be the expression,—or perhaps, the ignorance.

ly, so far as the characters given would indicate, the species do not differ subgenerically from those forms of *Heptadactylus*. As it might be replied that the dentiform lobes between the digitations were also considered as digitations, it is not superfluous to add that the species of *Harpago* have similar dentiform lobes. The Adamsian groups are indeed natural, but in spite of their diagnoses. The value of those groups is by no means equal, however. It is quite true that there may be great inequality in the value of natural genera, and that some naturalists would recognize genera in the *Pterocera* of the *lambis* form on the one hand, and those of the *scorpio* and *millipeda* on the other, or, indeed, in each form. This would be a simple question of appreciation of values; the present writer is indisposed to regard the differences as of generic importance.

Mr. Gabb's combination of the rugose *Pterocera* with the species of *Harpago* in a single genus contradistinguished from the *Pterocera* with smooth lips, it must be confessed, was not a happy modification, as that able naturalist, on reconsideration, would doubtless admit.

In pursuance of the views explained, the Lamarckian *Pterocera* will therefore be re-distributed among two genera, on the bases already indicated and as set forth in the following diagnoses.

The differences in the dentition of the radula between the genera are immaterial, but so are those between the *Pterocera* and the *Strombi*, as defined; it is possible that the apparent differences between the two may be still further reduced or altogether nullified by the examination of other species.

§ 5. DESCRIPTIVE.

PTEROCERA, Lamarck.

Historical Synonymy.

Aporrhais, sp. Aldrovandi, De Test. pp. 343, 344.

Radix bryoniae, sp. Klein, Tent. Meth. Ostrac. 1753, p. 79.

Heptadactylus, sp. Klein, op. cit. p. 99.

Millipes, sp. Klein. op. cit. p. 99.

Binomial Synonymy.

< *Strombus*, Humphrey, Mus. Calonn. 1798, p. 39. (Not limited by description.)

< *Pterocera*, Lam., Prod. 1799, p. 72; Syst. An. sans Vert. 1801, p. 80. (*P. lambis*.)

< *Pteroceres*, Montf., Conch. Syst. ii, 1810, p. 606. (*P. scorpio*)

< *Digitata*, Fabr., Fort. 1822, p. 86.

> *Pterocera* (*Millipes*), Mörch, Cat. Yoldi, i, 1852, p. 60. (Not described.)

- > *Pterocera* (*Heptadactylus*), Mörch, op. cit. p. 60. (Not described.)
 > *Harpago* (*Millipes*),* H. and A. Adams, Gen. Moll. i, 1858, p. 261.
 > *Harpago* (*Heptadactylus*),* H. and A. Adams, op. cit. p. 261.
 < *Pterocera* (*Pterocera*), Gabb, Am. Jour. Conch. iv, 1868, p. 139.
Strombus, sp. Linn. et al.
Lambis, sp. Bolten.
Pterocera (*Millipes*), sp. Gabb.

Animal stromboid; radula (*S. lambis*, *bryonia*) with the *rhachidian* teeth two and a half to three times as wide as long, somewhat narrowed towards base, with a large convex median tooth, and two or three smaller on each side; inner plate oblong rhomboidal, with a heel developed on the inner part of the basal border, and a process near the base and from the external edge; cutting margin with a large inner pointed tooth and three or four smaller ones; *lateral plates* very long, narrow and curved, armed on the anterior margin near the point with from three to six teeth; outer lateral plate broader at base than inner. (Troschel.)†

Shell obconoid, with the spire moderately elevated, the canal produced into a long involute digitation, tortuous and inclined towards the right, the labrum much alated and produced into spiniform digitations, and with the sinus deep and entirely lateral.‡ *Whorls* concave between the angle and the suture, coarsely spirally striated, and with six§ more or less developed primary fascioles, emitting as many involute primary digitations, of which the sutural or posterior is accumbent on the spire and continued backwards from the apex, three radiate from and near the angle, and two are between the latter and the sinus; secondary fascioles and spines are, in some species, interposed between the primary; antesinual lobe unarmed. *Aperture* linear, continued to the posterior boundary of the whorl.

* The Messrs. Adams called these subgenera, but they always employ their subgenera in a generic sense.

† Dr. Troschel refers to a figure of *P. lambis*, but the one cited represents *Aporrhais*, under which reference is again made to the same figure.

‡ The "entirely lateral" sinus contrasts with the anterior position characteristic of the genus *Euprotomus* (*St. auris-dianæ*, etc.), in which the expansion of the lip and deflection of the anterior portion of the shell and revolving striæ throw it entirely forwards.

§ The exceptional number of seven is developed in *P. violacea*.

SPECIES.

Eight distinctly marked species are distinguishable among the forms that have been described or indicated. These may be naturally grouped with reference to the development of certain characters. Of primary importance seems to be the condition of labial surface, some being smooth and others rugose at that region; those having rugose lips differ again in the development of the processes between the primary labral spines, such processes being generally simple lobes in some species, while in others they are extended into involute spines. The general form, ornamentation, development of the lip, and especially of the spines, in their respective variations furnish other excellent characters for the discrimination of the species. As several important differences seem to have hitherto been generally overlooked, the following synopsis and amended but incomplete diagnoses of the species may be acceptable:

Synopsis.

I. Lips smooth.

Ia. Body whorl tuberculated at the angle.

Lip everted; columella with callus diffused, *P. lambis*.

Lip inflected; columella with callus stratified, *P. crocata*.

Ib. Body whorl unarmed at angle, *P. bryonia*.

II. Lips rugose.

IIa. Intercalary digitations none.

Posterior digitation with a basal lobe, *P. scorpius*.

Posterior digitation simple, *P. pseudoscorpio*.

IIb. Intercalary digitations developed.

Posterior digitation simple, *P. millipeda*.

Posterior digitation with a basal lobe.

Labral digitations 8; labral wrinkles very distinct, *P. elongata*.

Labral digitations 10; labral wrinkles faint, *P. violacea*.

A. Aperture smooth within. Primary digitations of labrum only developed; six, or exceptionally seven in number.*

1. *P. LAMBIS*, Lam. ex Linn.

Strombus lambis, Linn., Syst. Nat. ed. 12, p. 1208.

Pterocère scorpion, Blainv., Malac. pl. 25, f. 3, 4. (not Lam.)

* In a specimen of *P. bryonia* in the collection of the Smithsonian Institution, there are four angular spines, the lower of which is forked, as in an example mentioned by Humphrey.

Pterocera lambis, Lam., Prod. p. 72; Hist. Nat. An. sans Vert. ed. 2, ix, 672. Reeve, Mon. Pterocera, sp. 8.

Pterocera (Heptadactylus) lambis, Mörch, Cat. Yoldi, p. 60.

Heptadactylus lambis, Ad. f. Gen. Moll. i, p. 261.

Harpago lambis, Ad. f. Gen. Moll. Atlas, pl. 27, f. 2.

Angular fasciole carinated on spire, on the last whorl provided with two enlarged tubercles; labium with the callus diffused; labrum with the margin (normally) eflacted, with the spines eflacted outward and rather small, and with the ante-sinual lobe undulated. Lips whitish, more or less sanguineous within and behind.

Hab.—Philippine Islands and Ceylon.

2. *P. CROCATA*, Link.*

Pterocera crocata, Link, Verz. Nat. Samml. Rostock?

Pterocera aurantia, Lam., Hist. Nat. An. sans Vert. ed. 2, ix, 675. Reeve, Mon. Pterocera, sp. 7.

Pterocera (Heptadactylus) crocata, Mörch, Cat. Yoldi, i, p. 60.

Heptadactylus crocatus, Ad. f. Gen. Moll. i, p. 261.

Angular fasciole carinated on spire, and on the last whorl armed with two enlarged tubercles; labium with the callus concentrated, and stratified or folded near aperture; labrum with its margin inflected, the digitations successively more recurved, and the antesignal lobe tridentate. Lips more or less orange or saffron-colored.

Hab.—Philippine Islands.

3. *P. BRYONIA*, Reeve ex Gmel.

Strombus radix bryonia, Chem., Conch. Cab. x, p. 227, pl. 159, f. 1512-15.

Strombus bryonia, Gmel. in Linn. Syst. Nat. ed. 13, p. 3520.

Strombus truncatus, Dillw., Cat. ii, p. 659.

Pterocera truncata, Lam., Hist. Nat. An. sans Vert. ed. 2, ix, p. 671. Kiener, Spec. Gen. Pterocère, p. 3, pls. 1 and 10.

Pterocera bryonia, Reeve, Mon. Pterocera, sp. 1.

Pterocera Sebæ, Kiener (ex Val.), Spec. Gen. Pterocère, p. 4, pl. 2, and pl. 4, f. 2

Pterocera radix bryoniae, Mörch, Cat. Yoldi, p. 60.

Heptadactylus radix-bryoniae, Ad. f. Gen. Moll. i, p. 261.

Young. *Pyrula bengalina*, Grat., 1840.

Angle coronated or tuberculigerous on spire, *unarmed*

* This name is accepted on authority of Mörch and Adams.

on the last whorl; labium with the callus diffused; labrum with its margin erect, with six moderate digitations, and with the antesinual lobe little undulated. Lips whitish or lurid.

Hab.—Society Islands.

B. Aperture corrugated within. (*Millipes*, Mörch, Ad. f.)

1. Digitations of labrum six, between the median of which are dentiform processes.

4. *P. SCORPIUS*, Lam. ex Linn.

Strombus scorpius, Linn., Syst. Nat. ed. 12, p. 1208.

Pterocera nodosa, Encycl., pl. 410, f. 2. Swains., Exotic Conch. App. p. 32.

Pterocera scorpio, Lam., Hist. Nat. An. sans Vert. ed. 2, ix, p. 674.

Pterocera scorpius, Reeve, Mon. Pterocera, sp. 3.

Pterocera (Millipes) scorpio, Mörch, Cat. Yoldi, p. 60.

Millipes scorpio, Ad. f. Gen. Moll. i, p. 261.

Pterocera (Millipes) scorpio, Gabb, Am. Journ. Conch. iv, p. 140.

Labrum with a prominent transverse white ridge in front of the concavity of the dorsal tubercle; laterally inflected, ribbed between the spines, and with a dentated margin; the spines nodose, and the posterior furnished with a compressed auriform lobe at the left base.

Hab.—Philippine Islands.

5. *P. PSEUDOSCORPIO*, Lam.

Pterocera pseudo-scorpio, Lam., Hist. Nat. An. sans Vert. ed. 2, ix, p. 674. Reeve, Mon. Pterocera, sp. 4.

Pterocera (Harpago) pseudoscorpio, Mörch, Cat. Yoldi, p. 60.

Millipes pseudoscorpio, Ad. f. Gen. Moll. i, p. 261.

Labrum with no distinct ridge behind, and with the concavity of the tubercle mostly in advance of the columellar fold; moderately inflected, with single dentiform lobes between the angular and median, and median and postsinual spines; with spines obsolete or not at all nodose, and the posterior simple and with no basal lobe.

Hab.—Zanzibar, etc.

This very distinct species has hitherto only been distinguished from *P. scorpius* by the larger size and larger and less nodose spines, and consequently it was natural that Reeve and others should have been of the opinion that "it is extremely doubtful

whether this is anything more than a local variety of the foregoing species." Kiener, acting on this opinion, united it with *P. scorpio*, adding that the only difference he could perceive were the slight superiority in size, and the thicker and less nodulose digitations.

2. Digitations of labrum separated by secondary ones intercalated at the right margin.

The validity of three species of this section is now no longer questioned, but it must be confessed that, however readily they may be recognized, some of their most distinctive characters have not been alluded to in the diagnoses published. Without repeating characters generally given, they may be additionally distinguished as follows :

6. *P. MILLIPEDA*, Lam. ex Linn.

Strombus millipeda, Linn., Syst. Nat. ed. 12. p. 1208.

Pterocera millipeda, Lam., Hist. Nat. An. sans Vert. ed. 2, ix, p. 673; Reeve, Mon. Pterocera, sp. 10.

Pterocera (Millipes) millipeda, Mörch, Cat. Yoldi, p. 60.

Millipes millipeda, Adams, f. Gen. Moll. i, p. 261.

Angle armed with four digitations, the uppermost (rarely null) being an intercalated one; posterior digitation simple; lateral digitations, especially the primary, much recurved; lips with wrinkles moderately developed.

Hab.—Philippine Islands.

7. *P. ELONGATA*, Swains.

Strombus novem-dactylis instructus, Chem., Conch. Cab. x, p. 207, pl. 155, f. 1479, 1480.

Strombus millipeda, var. B., Dillw., Cat. ii, p. 660.

Pterocera millipeda, part Lam., Hist. Nat. An. sans Vert. ed. 2, ix, p. 673 (Syn. part; *not desc.*)

Pterocera elongata, Swains., Exotic Conch., App. p. 32. Reeve, Mon. Pterocera, sp. 9.

Pterocera crocea, Sowb., Thes. Conch. p. 11, f. 4.

Millipes elongatus, Ad. f. Gen. Moll. i, p. 261.

Angle armed with the three normal digitations; posterior digitation furnished with a lobe at its left base; lateral digitations straight; lips with wrinkles well developed.

Hab.—?

8. P. VIOLACEA, Swains.

Strombus multipes, Chem., Conch. Cab. x, p. 216, pl. 157, f. 1494-5 (not binomial author).

Pterocera millipeda, part Lam., Hist. Nat. An. sans Vert. ed. 2, ix, p. 673 (Syn. part; not desc.)

Pterocera violacea, Swains., Exotic Conch., App. p. 33.

Pterocera multipes, Desh., in Lam. Hist. Nat. An. sans Vert. ed. 2, ix, p. 677. Reeve, Mon. Pterocera, sp. 5.

Millipes multipes, Ad. f. Gen. Moll. i, p. 261.

Angle armed with three digitations; a posterior and an anterior median fasciole in place of the normal single fasciole; posterior digitation with an elongated lobe at its left base; lateral digitations straight or little curved; all the digitations are channelled and not involute; wrinkles on the labium anteriorly faint or obsolete.

Hab.—East Coast of Africa, fide Reeve.

HARPAGO, H. and A. Adams ex Klein.

Synonymy.

= *Harpago*, Klein, Tent. Meth. Ostrac. 1753, p. 79 (not binomial).

= *Pterocera (Harpago)*, Mörch, Cat. Yoldi, i, 1852, p. 60 (not described).

= *Harpago*, H. and A. Ad., Gen. Moll. i, 1858, p. 60.

> *Harpago*, Gabb, Am. Journ. Conch. iv, 1868, p. 140.

Strombus, sp. Linn., Humphrey, &c.

Lambis, sp. Bolten.

Pterocera, sp. Lam., &c.

Animal stromboid; radula (*H. chiragra*) with the rhachidian teeth transversely oblong, about twice as wide as long, and contracted towards the base, with a large median and two smaller teeth on each side; inner plates oblong-rhomboidal or trapezoidal, with a continuous, but sinuous hinder margin, with very large inner tooth, followed by three smaller ones and a cutting ledge; lateral plates very long, narrow and curved, armed with about five teeth on the anterior margin near the tips. (Troschel.)

Shell obconoid, with the spire moderately elevated, the canal produced into a long involute digitation boldly recurved towards the left, with a sinus at its base; the labrum much alated and produced into spiniform digitations, and with the sinus deep and entirely lateral. *Whorls* concave between the angle and suture, coarsely spirally striated, and with fascioles (except sutural) well developed, the subsutural emitting a spine not accumbent on the

spire, directed backwards, and the sutural a second accumbent on and crossing the spire, and recurved towards the left and backwards; angular and median emitting single recurved spines; postsinual unarmed; lobal emitting a large recurved spine in advance of the middle of the ante-sinual lobe.

Aperture unguiform, contracted behind by the development of longitudinal callous ridges, which are almost applied on each other, the columellar being outermost.

The two species may be briefly distinguished as follows:

1. HARPAGO CHIRAGRA, Adams f. ex Linn.

Strombus chiragra, Linn., Syst. Nat. ed. 12, p. 1207.

Pterocera chiragra, Lam., Hist. Nat. An. sans Vert. ed. 2, ix, p. 675. Reeve, Mon. Pterocera, sp. 2.

Pterocera (Harpago) chiragra, Mörch, Cat. Yoldi, i, p. 60.

Harpago chiragra, Ad. f. Gen. Moll. i, p. 261.

Fascioles, angular tuberculated, others almost unarmed, ante-sinual with a compressed tubercle near the base of the digitation; lips rosaceous, with very faint and almost obsolete wrinkles; sutural digitation with a canal open at base, the outer border being bent outwards and attached above the angle of the body whorl, on which the digitation is chiefly bent and accumbent. Large.

Hab.—Society Islands.

2. HARPAGO RUGOSA, ex Sowerby.

Pterocera chiragra, part Lam., Hist. Nat. An. sans Vert. ed. 2, ix, p. 675 (Syn. part; *not desc.*)

Pterocera rugosa, Sowb., Thes. Conch. part 2, pl. 11, f. 9, 10. Reeve, Mon. Pterocera, sp. 6.

Pterocera (Harpago) arthritica, Mörch, Cat. Yoldi, p. 60.

Harpago arthriticus, Ad. f. Gen. Moll. i, p. 261.

Fascioles, except sutural and ante-sinual, with prominent tubercles; ante-sinual smooth; lips with very prominent white wrinkles, contrasted strongly with the deep purplish or blackish ground; basal posterior digitation with its canal closed by the reflection of its margins, and accumbent on the middle of the spire. Size moderate.

Hab.—Eastern seas.

§ 6. EXTINCT ASSOCIATES.

To the genus *Pterocera* have been referred numerous species by various authors, most of which, however, have been success-

ively eliminated therefrom by others, and have served as constituents of new genera, or been associated with previously established ones. The propriety of the elimination of the forms which have been referred to the genera *Aporrhais* and its dismemberments, *Alaria*, *Diarthema*, *Pterocerella*, *Dicroloma*, and *Tessarolax*, may be at once admitted. With equal propriety has Mr. Gabb eliminated *P. speciosa*, *P. Dupiniana*, and *P. marginata*, all described by d'Orbigny, from the residuum, but the propriety of combining those three together in one subgenus, to be considered as of *Pterocera*, is questionable, especially as the typical species is not provided "with a straight or recurved canal anteriorly, and a canal ascending the spire posteriorly;" or an "outer lip digitate;" its relations, indeed, appear to be rather with the typical Strombidæ.

After all these eliminations, as Mr. Gabb has remarked, "in the cretaceous and jurassic formations are many shells with all the characters called for in the commonly received definition of *Pterocera*, but having a peculiar 'facies' of their own," yet from which, "except in general appearance [he] can find no difference," and thus, by the latest reviser of the group, they are left in *Pterocera*. This residuum, however, contains no species to which the amended diagnoses of *Pterocera* and *Harpago* are applicable, and it is by no means certain that any are at all related to those genera. There are, however, two types which have at least considerable superficial resemblance to them, and which may possibly belong to the Strombidæ, but such appears to the writer improbable, and provisionally, at least, they may be more advantageously retained among the *Aporrhaidæ*. They do not appear to have the sinus characteristic of the *Strombidæ*; in one, indeed (*Pt. Moreausiana*, d'Orb.), a sinus might be considered to exist, on faith of the illustration, but the appearance is rather produced, there is reason to believe, by the extension of the anterior fasciole into an aborted lobe or digitation, and a consequent emargination between it and the median digitation. In order to secure for the forms in question due attention and re-examination, it seems advisable to especially designate them, but I have not had the opportunity of examining them, and derive my information respecting them solely from d'Orbigny's "Paléontologie Française."

HARPAGODES, Gill.

Pterocera, sp. d'Orb., etc.

Shell obconic or ovate-conoid, with the spire moderately elevated, the canal produced into a long digitation boldly recurved towards the left, and the labrum m

spiniiform digitations. Whorls convex or flat between the angle and suture, spirally ribbed, with larger rib-like angular, median, and anterior fascioles (and sometimes post-angular), each emitting long spiniiform digitations; and with a sutural canaliculate digitation accumbent on the spire, continued and recurved backwards. Cretaceous and Jurassic.

Type H. PELAGI.

Pterocera Pelagi, d'Orb., Pal. Franc., T. cret. ii, pl. 212.

CERATOSIPHON, Gill.

Shell fusi-conic, with the spire considerably elevated, the canal produced into a long digitation recurved towards the left, and the labrum much alated and produced into spiniiform digitations. Whorls concave or flat between the angle and suture, spirally striated, and with rib-like angular, median, and anterior fascioles, of which the two former, at least, emit spiniiform digitations, the sutural emitting a digitiform canal accumbent on the spire and directed backwards.

Type C. MOREAUSIANA.

Pterocera Moreausiana, d'Orb., Pal. Franc., T. cret. ii, pl. 211, f. 1.

Distinguished by the elongated hamiform siphonal canal and the posterior canal co-ordinated with the "facies" of *Aporrhais*.

§ 7. APPENDIX.

As the useful "Manuel de Conchyliologie" of Dr. Chenu is the guide of many conchologists, the species figured therein may be here identified with propriety, especially as some of the species have been misunderstood. Fig. 1612 represents *H. rugosa*, not "*P. chiragra*"; 1613, "*P. lombis*" correctly; 1614, "*P. multipes*" = *P. violacea* correctly; 1615, *P. pseudoscorpio*, not "*P. scorpio*"; 1616, *P. violacea*, not "*P. millipeda*"; 1617, "*P. elongatus*" = *P. elongata* correctly.

MATERIALS FOR A MONOGRAPH OF THE FAMILY
LEPETIDÆ.

BY WM. H. DALL.

I have to thank Dr. Stimpson, of the Chicago Academy of Sciences, for the use of material, and am much indebted to the Smithsonian Institution for the use of the specimens in their cabinet, for the purposes of comparison.

Any contribution to science, tending to clear up the uncertainty which hangs over many shells, supposed to be circumboreal, or otherwise, is not without value, and perhaps for this family in particular, which has been more or less misunderstood and confused by every author who has mentioned it, principally from the habit of copying from one author to another, without original verification.

Family *LEPETIDÆ*.

Syn. *Lepetidæ*, Gray, Guide, p. 172.

Patellea, *** Lovèn, p. 199.

Patellidæ, (pars), Auct.

Tecturidæ, (pars), Jeffreys, Adams.

Characters.—Branchiæ none. Eyes none. Rostrum provided with labial tentacles. Dental formula $\frac{1}{2 \times 2}$. Rhachidian tooth rhomboidal, cuspidate. Laterals slender, cuspidate. Shell patelliform.

Genus LEPETA, Gray, P. Z. S. 1847, p. 168.

Syn. *Patella* (pars), auct.

Cryptobranchia (pars), Midd., Sib. Reise, p. 183, 1851.
Schrenck, R. v. Amurl. p. 291, 1867.

Propilidium, Gray, Guide Moll. p. 172. H. and A. Ad.,
Gen. R. Moll. p. 462. (Not Forbes and Hanley.)

Pitidium, Stimps., Shells of N. E. (Not Forbes and
Hanley, nor Middendorf.)

Scutellina, Chenu, Manual, p. 375 (pars).